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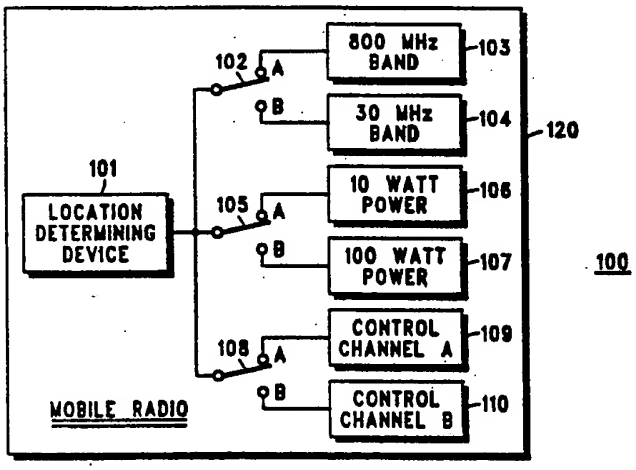
(54) Title: LOCATION-BASED ADAPTIVE RADIO CONTROL

(57) Abstract

A method (200) and apparatus (100) is provided for a radio having adjustable operating parameters to adjust at least one such adjustable operating parameter based on the current location of the radio. Operating parameters which may be so adjusted include, but are not limited to, the following: transmitting power (106, 107), operating channel, operating band (103, 104), modulation type, modulation index, frequency deviation, squelch setting, channel spacing, control channel (109, 110) (for trunked communications), noise blanker characteristic, and receive bandwidth. The location is determined by the radio (101).



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LOCATION-BASED ADAPTIVE RADIO CONTROL

Background of the Invention

This invention pertains to radios.

Two-way radios have a number of operating parameters including, but not limited to, transmitting power, operating frequencies (channel), operating band, modulation type, modulation index, frequency deviation, squelch setting, channel spacing, control channel (for trunked communications), noise blanker characteristic, and receive bandwidth. Of these parameters, some are fixed, while others may be, to some degree, variable. One example of a parameter which is usually, but not always, fixed is the modulation type, such as FM or AM. One example of a parameter which is usually, but not always, variable is the operating frequency or frequencies (channel).

At a given time, it may be desirable to adjust the operating parameters in response to the current operating environment to obtain optimum performance. For example, it may be desirable to minimize interference to other users.

A significant factor in determining the current optimum operating parameters is the geographic location of the radio. As an example, a particular radio operating in a densely-populated area, such as downtown

Los Angeles, California must contend with, among other factors, a relatively large number of other radios using the same frequency spectrum. As a result, the available frequencies (channels) may be limited. Also, the radio must limit its transmitting power to avoid interfering with neighboring users. On the other hand, if this identical radio were located in the middle of a sparsely-populated area, such as Death Valley, California, it would contend with few (if any) other radios using the same frequency spectrum. As a result, more channels are available and the transmitting power may be increased to achieve greater range without interfering with neighboring users.

For radios which are fixed in location, that is, non-mobile, usually there are few parameters, if any, which need to be varied during day-to-day operation. This is because the operating environment is relatively constant for the radio which is due, to a large extent, to the fact that the location of the radio is fixed.

For radios whose location is not fixed (that is, mobile), on the other hand, it is desirable for operating parameters to be adjusted whenever a change in the location of the radio causes the operating environment to change. For example, using our above example, if a mobile radio initially selects an operating frequency band and transmit power while it is located in downtown Los Angeles, the radio may need to periodically adjust (change) these frequency band and power settings as its location constantly changes during the course of its journey from the downtown area to a final destination of Death Valley. Moreover, it also may be advantageous to change other operating parameters during the course of such a journey.

Another situation where a mobile radio might need to adjust operating parameters based on its location arises in trunked radio systems. In such systems, many subscriber units share a fixed (and typically smaller)

number of communication channels. In such systems, a common control station uses a control channel to allocate the shared channels amongst the subscriber units. When a subscriber wishes to place a call, it first tunes to the control channel and transmits a channel request message to the control station. Upon receipt of this message (and assuming an idle channel is available) the control station reserves, or assigns, an idle channel for the call. The control station then transmits the channel assignment information to the requesting subscriber via the control channel. Upon receipt of this channel assignment message, the requesting subscriber unit tunes to the assigned channel and proceeds to place its call.

A possible scenario which might arise in such trunked systems is a mobile subscriber unit which travels in geographic region A served by trunked system A with associated control channel A, and which mobile subscriber unit also travels in region B served by trunked system B with associated control channel B. With present trunked radio systems, no convenient mechanism exists to allow the subscriber unit to easily and readily change from one trunked system to another when travelling in this way.

In general, then, it is desirable for a mobile radio to have the ability to change operating parameters based on its current location. Given this fact, the question arises of how to effect the desired changes in the operating parameters. While it is obvious the human operator could manually adjust the operating parameters to obtain optimum performance, this could also prove to be risky. This is because, due to human error, the operator may be mistaken as to either the present location of the radio, or the current optimum operating parameters for the present location of the radio, or both.

Summary of the Invention

Therefore, it is an object of the present invention to vary one or more operating parameters of a mobile radio automatically, and without human intervention, based on the location of the radio. According to the invention, a method is provided, and an apparatus described, whereby one or more operating parameters of a mobile radio may be varied automatically, and without human intervention, based on the location of the radio.

Brief Description of the Drawings

Fig. 1 depicts the location-based adaptive radio control arrangement.

Fig. 2 depicts a flow diagram illustrating the steps of the invention.

Detailed Description of the Invention

The invention may be used with any location determining device or system (101), such as LORAN, satellite global positioning systems, or dead reckoning, and with any mobile radio having adjustable operating parameters. Such location determining systems are well understood and need not be described here in any further detail. (In the context of this invention, "mobile" refers to a non-fixed location radio, and includes both vehicle mounted and personally carried radios.)

The invention (100) is shown in Fig. 1.

Switch 1 (102) is arranged to select the operating frequency band of the radio. When switch 1 is in position designated "A", the radio operates on the 800 MHz band (103). When switch 1 is in the position designated "B", the radio operates on the 30 MHz band (104).

Switch 2 (105) is arranged to select the output power level of the transmitter. When switch 2 is in the position designated "A", the output power is 10 Watts (106). When switch 2 is in the position designated "B", the output power is 100 Watts (107).

Switch 3 (108) is arranged to select the control channel of the radio. When switch 3 is in the position designated "A", the control channel selected is channel A (109). When switch 3 is in position designated "B", the control channel selected is channel B (110).

The mobile radio (120) is equipped with a location determining device (101) which, in turn, is arranged to control the position of switch 1 (102), switch 2 (105), and switch 3 (108). In this embodiment, the location determining device (101) is capable of determining whether the radio is located in location A (the urban area) or location B (the rural area).

When the location determining device (101) determines the radio is located in location A, it causes switch 1 (102) to reside in position "A", thereby causing the radio to operate on the 800 MHz band. Also when the location determining device (101) determines the radio is located in location A, it causes switch 2 (105) to reside in position "A", thereby causing the radio to transmit at 10 Watts power output. Finally, when the location determining device (101) determines the radio is located in location A, it causes switch 3 (108) to also reside in position "A", thereby causing the radio to use channel A as a control channel.

When the location determining device (101) determines the radio is located in location B, it causes switch 1 (102) to reside in position "B", thereby causing the radio to operate on the 30 MHz band. Also when the location determining device (101) determines the radio is located in location B, it causes switch 2 (105) to reside in position "B", thereby causing the radio to transmit at 100 Watts power output. Finally, when the location

determining device (101) determines the radio is located in location B, it causes switch 3 (108) to reside in position "B", thereby causing the radio to use channel B as a control channel.

Fig. 2 shows the flow diagram (200) of the steps of the invention.

The process starts with the radio determining its location (201). If the radio determines it is located in a first predetermined location, such as location A (the urban area), the radio operates on the 800 MHz band (202), adjusts the transmitter to 10 Watts of output power (203), and uses channel A as a control channel (204). The radio then returns (220) to its initial determining step (201), and makes a new determination of its location.

In this embodiment, if the radio determines it is located in location B (the rural area), the radio operates on the 30 MHz band (212), adjusts its transmitter to 100 Watts of output power (213), and uses channel B as a control channel (214). The radio then returns (220) to its initial determining step (201), and makes a new determination of its location.

What is claimed is:

CLAIMS:

1. A method for adjusting a radio comprising the steps of: in said radio:

(a) determining said radio's location; and,

(b) responsive to said determination, automatically adjusting at least one variable operating parameter.

2. A method for adjusting a radio, comprising the steps of: in said radio:

(a) determining when said radio is located within a predetermined region; and,

(b) responsive to said determination, automatically adjusting at least one variable operating parameter.

3. A method for adjusting a radio, comprising the steps of: in said radio:

(a) determining which of several predetermined regions said radio is located within; and,

(b) responsive to said determination, automatically adjusting at least one variable operating parameter.

4. A method for adjusting a radio, comprising the steps of:

(a) determining said radio's distance from at least one predetermined fixed point; and,

(b) responsive to said determination, automatically adjusting at least one variable operating parameter.

5. A radio having adjusting means, said adjusting means comprising:

means for determining said radio's location; and,

means responsive to said determining means for automatically adjusting at least one variable operating parameter.

6. A radio having adjusting means, said adjusting means comprising:

means for determining when said radio is located within a predetermined region; and,

means responsive to said determining means for automatically adjusting at least one variable operating parameter.

7. A radio having adjusting means, said adjusting means comprising:

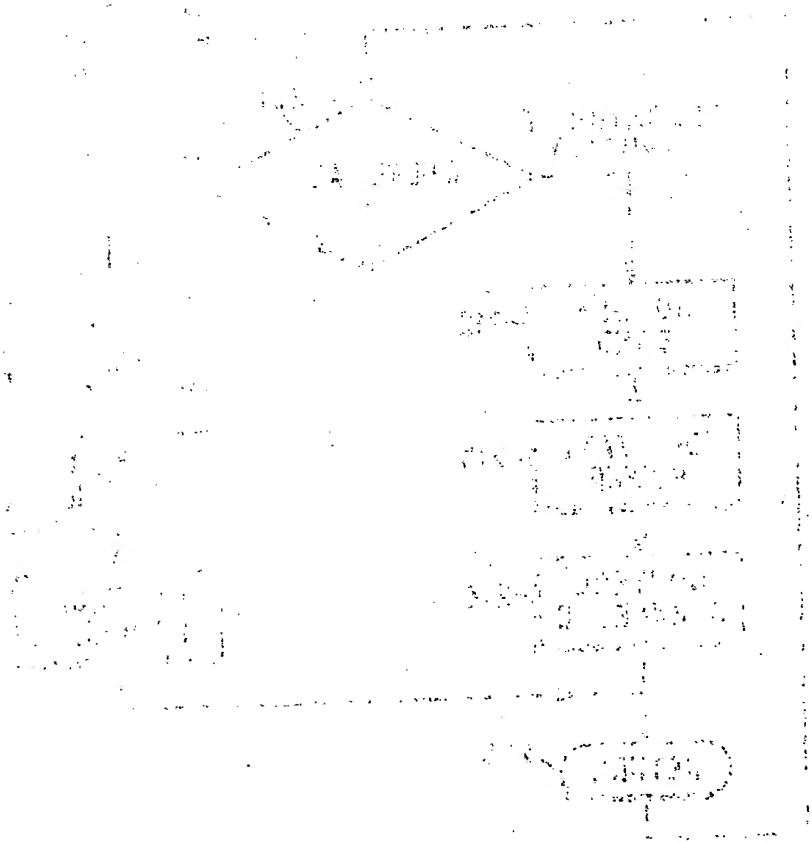
means for determining which of several predetermined regions said mobile radio is located within; and,

means responsive to said determining means for automatically adjusting at least one variable operating parameter.

8. A radio having adjusting means, said adjusting means comprising:

means for determining said radio's distance from at least one predetermined fixed point; and,

means responsive to said determining means for automatically adjusting at least one variable operating parameter.



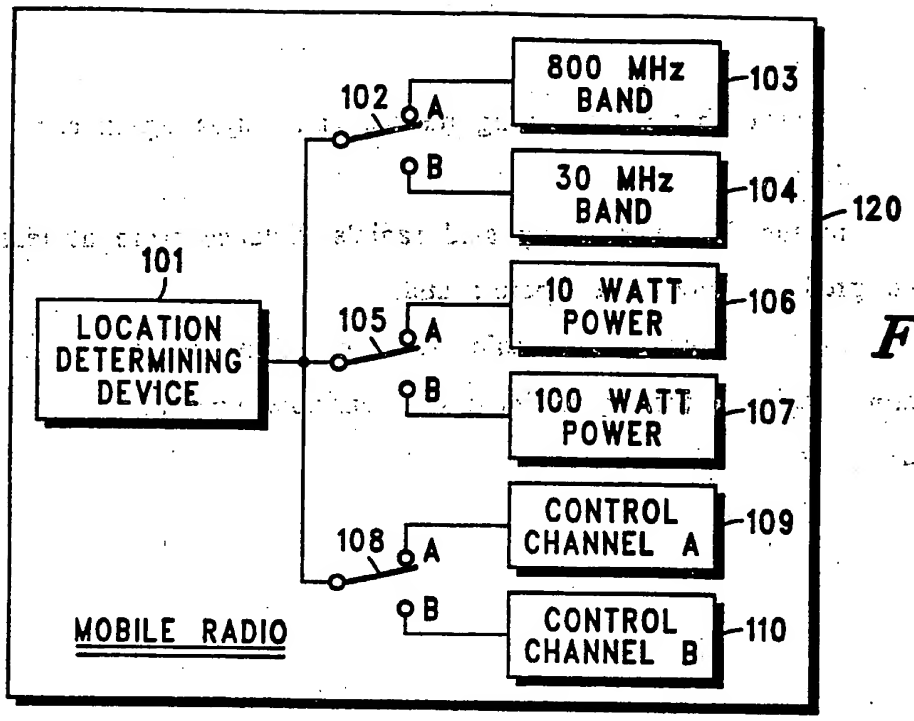
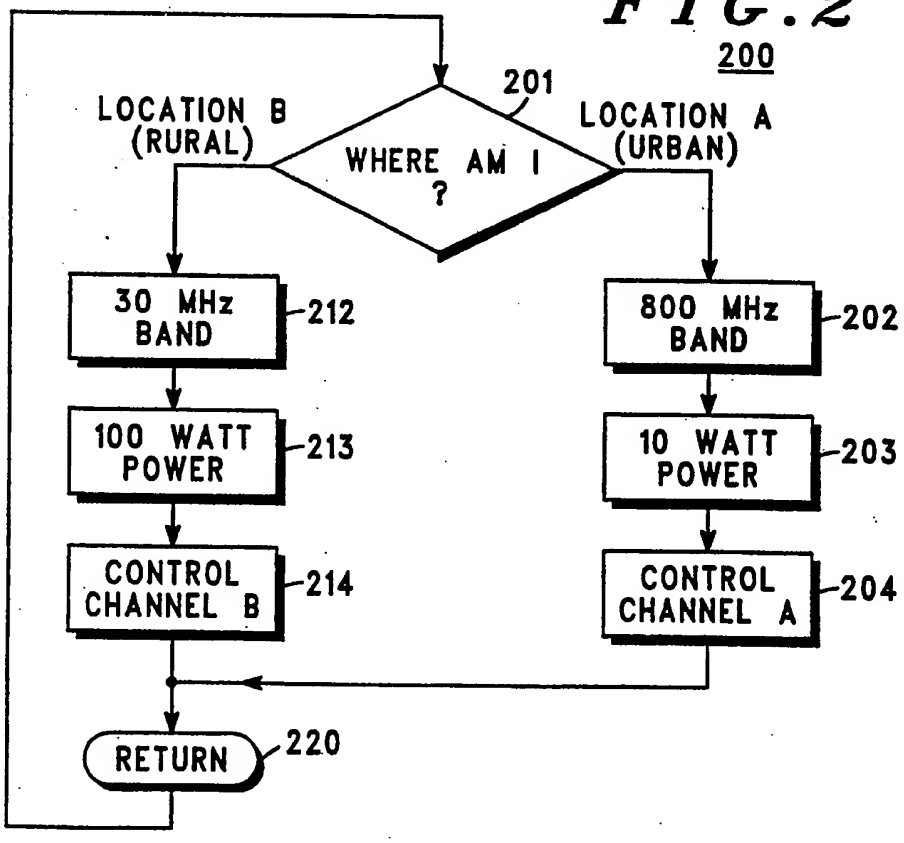


FIG.1

100

FIG.2

200



INTERNATIONAL SEARCH REPORT

International Application No. PCT/US89/03452

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl4 H04B 7/24
U.S. Cl. 455/33

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	455: 33, 35, 62, 67, 54, 88, 89, 127, 166, 183, 184, 185, 186, 200, 212, 218, 221 342: 419, 457

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	US, A, 4,476,582 Strauss et al 09 October 1984, See the Figure and column 2, lines 39 to 68 and column 5, lines 3 to 16 and 44-61.	1-8
A	US, A, 4,550,443 Freeburg 29 October 1985.	1-8
A	US, A 4,765,753 Schmidt 23 August 1988	1-8
A	US, A, 3,906,166 Cooper et al. 16 September 1975.	1-8

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
31 October 1989	29 NOV 1989
International Searching Authority	**Signature of Authorized Officer**
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